



Soil, Water and Environment Discipline, Khulna University
First Year Second Term; Examination Year 2026; Session: 2024-2025
Course Code: 0888 13 **SWE-1211**; Course Title: **Soil Chemistry I**
Full Marks: 60; Time: 03 Hours

❖ The figures in the right margin indicate marks. All the questions are of equal value. Use a separate answer script for each section.

Section A (There are four questions in this section. Answer any three questions.)

1.
 - a) Outline the criteria used to determine whether a nutrient is essential for plant growth. [L2, CLO1] 03
 - b) Explain how soil chemistry is connected to environmental toxicology. [L2, CLO1] 03
 - c) Differentiate between macronutrients and micronutrients required for plant growth and briefly explain how their primary sources in soil may differ. [L4, CLO1] 04
2.
 - a) Explain the relationship between soil texture and organic matter accumulation. [L2, CLO3] 02
 - b) The C:N ratio of added plant residues is 80:1. Analyze how this high C:N ratio is likely to affect N availability to crops in the short term. [L4, CLO3] 03
 - c) Outline the practices that increase soil organic matter. [L2, CLO3] 02
 - d) Classify humic substances. [L2, CLO3] 03
3.
 - a) Illustrate the chemical composition of soil solution. [L2, CLO3] 02
 - b) Outline the factors affecting the composition of the soil solution. (L1, CLO1) 03
 - c) Explain the dynamic aspect of soil solution. [L2, CLO3] 05
4.
 - a) Soil pH value in between 6 and 7.5 is called the most favourable range for plant growth-Justify [L2, CLO3] 03
 - b) Describe the sources of hydrogen ions in soil. (L2, CLO2) 04
 - c) Explain how aluminium contributes to both soil acidity and plant toxicity. [L2, CLO3] 03

Section B (There are four questions in this section. Answer any three questions.)

1.
 - a) Define Gibbs free energy mentioning its components. (L1, CLO1) 02
 - b) How can you relate the decomposition of soil organic matter to the Gibbs free energy change? (L2, CLO3) 02
 - c) What is the difference between ion concentration and ion activity? (L1, CLO1) 03
 - d) Why is ΔG important in soil chemistry? (L1, CLO1) 03
2.
 - a) Explain how ion-ion interactions (e.g., antagonism or synergism) can affect nutrient uptake by plants. [L2, CLO2] 02
 - b) How does surface potential affect the ion exchange reaction? (L1, CLO2) 03
 - c) Describe the role of clay particles on the CEC of soil. (L2, CLO2) 03
 - d) Why is CaCO_3 more effective in neutralizing acidic soil than CaCl_2 ? (L1, CLO2) 02
3.
 - a) Define EC and Eh with an example. (L1, CLO1) 02
 - b) Illustrate various techniques for the measurement of EC in soil. (L2, CLO3) 03
 - c) How does EC guide the management of irrigation water? (L2, CLO3) 02
 - d) Describe the role of Eh on nutrient availability in soil? (L2, CLO3) 03
4.
 - a) Define the ratio law with an example. (L1, CLO1) 02
 - b) A soil contains 4% humus, 10% montmorillonite, 10% vermiculite and 10% Fe and Al oxide. Calculate its CEC. (L1, CLO1) 02
 - c) Define chemisorption with example. (L1, CLO2) 03
 - d) Outline the behavior of ions active in oxidation reduction reactions in soil. (L2, CLO3) 03

Levels of Bloom's Cognitive Domain:

[L1=Remember; L2=Understand; L3=Apply; L4=Analyze; L5=Evaluate; L6=Create]

CLO- Course Learning Outcomes



Soil, Water and Environment Discipline, Khulna University
First Year Second Term; Examination Year 2026; Session: 2024-2025
Course Code: 0888 13 SWE 1213; Course Title: **Soil Physics I**
Full Marks: 60; Time: 03 Hours

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Section A (There are four questions in this section. Answer any three questions.)

1.
 - a) Draw a properly labelled diagram illustrating the mass-volume relationship. [L2, CLO1] 02
 - b) Write the equations for bulk density, particle density, porosity, gravimetric water content, volumetric water content, and degree of saturation using conventional symbols, and define each symbol. [L1, CLO1] 03
 - c) A cylindrical soil core, 10 cm in diameter and 12 cm in length, was collected from the field. The total (wet) mass of the core was 2.2 kg. After oven-drying, the mass was 1.8 kg. The particle density (ρ_s) is known to be 2.65 g/cm³. Calculate: (a) The dry bulk density (ρ_b); (b) The porosity (f); (c) The gravimetric (mass) water content (w); (d) The volumetric water content (θ_v); and (e) The degree of saturation (S). [L3, CLO1] 05
2.
 - a) Construct a table with the required number of rows and columns to record data for particle size analysis. [L3, CLO2] 02
 - b) Describe the procedure for determining soil texture using the hydrometer method. [L2, CLO2] 04
 - c) Derive Stokes' law to show that the sedimentation parameter, 04
$$\theta = \left[\frac{18\eta h}{(D_p - D_w)g} \right]^{\frac{1}{2}} \cdot [L4, CLO2]$$
3.
 - a) Analyze how soil structure influences water movement, aeration, root growth, and carbon sequestration. [L4, CLO2] 04
 - b) Describe the hierarchical organization of soil particles and structural units according to Hadas (1987). [L2, CLO2] 03
 - c) Outline the findings of Swaby (1949) regarding the role of microbial decomposition products in soil aggregation. [L2, CLO2] 03
4.
 - a) How would you evaluate the structural condition of a soil sample? [L2, CLO3] 04
 - b) Which elements are primarily responsible for soil color? [L1, CLO3] 02
 - c) What is the Munsell color chart? How is it used in soil studies? [L2, CLO3] 02
 - d) Explain how different soil moisture regimes influence soil color development. [L4, CLO3] 02

Section B (There are four questions in this section. Answer any three questions.)

1.
 - a) Explain the molecular properties of water. [L2, CLO2] 03
 - b) How does surface tension influence water behavior at the air-water interface? [L2, CLO2] 03
 - c) Illustrate the factors of soil water potential. [L2, CLO2] 04
2.
 - a) Define the Atterberg limits. [L1, CLO3] 02
 - b) Illustrate the practical significance of Atterberg limits in soil mechanics and field applications. [L2, CLO3] 04
 - c) How is the Plasticity Index (PI) calculated? Analyze the effects of tillage below the Plastic Limit on soil physical properties. [L3, L4, CLO3] 02+02
3.
 - a) Define soil aeration. [L1, CLO2] 01
 - b) Explain the effects of poor soil aeration on plant metabolism and yield. [L2, CLO2] 03
 - c) Compare the composition of soil air and atmospheric air. [L4, CLO2] 02
 - d) Describe the mechanisms responsible for the renewal of soil air. [L2, CLO2] 04
4.
 - a) Define thermal lag. [L1, CLO3] 01
 - b) Explain the mechanisms of diurnal and seasonal thermal lag. [L2, CLO3] 03
 - c) Analyze the effects of soil temperature on seed germination and root growth. [L4, CLO3] 03
 - d) Outline the strategies for regulating soil temperature. [L2, CLO3] 03

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Soil, Water and Environment Discipline, Khulna University
First Year Second Term; Examination Year 2026; Session: 2024-2025
Course Code: 0314 13 **SOC-1253**; Course Title: **Principles of Sociology**
Full Marks: 60; Time: 03 Hours

❖ The figures in the right margin indicate marks. All the questions are of equal value. Use a separate answer script for each section.

Section A (There are four questions in this section. Answer any three questions.)

1. a) What do you understand by Sociology? [L1, CLO1] 03
b) Illustrate the nature and scope of Sociology in Soil, Water and Environmental Sciences. [L2, CLO1] 07
2. a) Distinguish between society and community. [L4, CLO2] 04
b) Critically analyze the 'Cultural lag theory'. [L4, CLO4] 06
3. a) What is division of labour? [L1, CLO2] 03
b) Explain different types of families. [L2, CLO2] 07
4. a) Explain the role of major social institutions in the process of socialization. [L5, CLO2] 04
b) Interpret the forms of social stratification. [L2, CLO4] 06

Section B (There are four questions in this section. Answer any three questions.)

1. a) What do you understand by mass media? [L1, CLO3] 03
b) Interpret the conflict approach of media. [L2, CLO3] 07
2. a) What is crime? [L1, CLO2] 03
b) Explain the factors of juvenile delinquency. [L2, CLO2] 07
3. a) Critically examine the contribution of major population theories in understanding demographic processes such as fertility, mortality and migration, and assess the extent to which these processes interact with health outcomes and environmental sustainability. [L4, CLO3] 10
4. a) What do you understand by social problem? [L1, CLO2] 03
b) How does neo-colonialism contribute to the emergence of Bangladesh? Discuss. [L6, CLO2] 07

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CLO- Course Learning Outcomes



Soil, Water and Environment Discipline, Khulna University
First Year Second Term; Examination Year 2025; Session: 2024-2025
Course Code: 0532 13 **Geol 1255**; Course Title: **Geology**
Full Marks: 60; Time: 03 Hours

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Section A (There are four questions in this section. Answer any three questions.)

1.
 - a) Define geology and lithology. [L1, CLO1] 03
 - b) Explain the scope and importance of geology. [L2, CLO1] 02
 - c) Distinguish a mineral from a rock. [L2, CLO1] 03
 - d) Differentiate between silicate and non-silicate minerals. [L3, CLO1] 02
2.
 - a) Classify common rock-forming minerals in igneous rocks. [L2, CLO1] 03
 - b) Distinguish intrusive and extrusive igneous rocks. [L4, CLO1] 03
 - c) Given a rock that is dark in color, fine-grained, and basaltic in composition, identify its rock type and justify your answer. [L3, CLO1] 04
3.
 - a) Compare and contrast the formation and typical transport history of conglomerate versus breccia. [L4, CLO1] 02
 - b) How can sedimentary texture and structures (e.g., rounding, sorting, ripple marks, mud cracks) be used to reconstruct past environments such as river, desert, or marine settings. [L3, CLO1] 03
 - c) You are given a hand specimen: coarse-grained with angular gravel clasts supported by a sandy matrix. Classify the sample as a specific clastic sedimentary rock type. [L2, CLO1] 05
4. Write short notes on the followings 2.5×4=10
 - a) Agents of metamorphism [L3, CLO1]
 - b) Diagnostic Mineral Properties [L3, CLO1]
 - c) Earth's Physical Layering [L3, CLO1]
 - d) Intrusive structures of igneous rocks [L3, CLO1]

Section B (There are four questions in this section. Answer any three questions.)

1.
 - a) Interpret the significance of "International Date Line". [L2, CLO3] 03
 - b) Categorize the various types of crustal deformations. [L4, CLO2] 04
 - c) Explain disconformity with diagram. [L2, CLO2] 03
2.
 - a) Illustrate the various aspects of earthquake as a natural disaster. [L3, CLO3] 03
 - b) Demonstrate the correlation of rocks by fossils. [L3, CLO2] 04
 - c) Draw the different types of faults. [L3, CLO3] 03
3.
 - a) Justify continental drift theory on the basis of i) distribution of fossils and ii) geological similarities. [L5, CLO3] 04
 - b) Outline the application of satellite imagery in modern world. [L2, CLO3] 03
 - c) Present cylindrical, conical and planer projection concepts with necessary diagram(s). [L3, CLO3] 03
4. Write short notes on the followings 2.5×4=10
 - a) Uniformitarianism [L3, CLO2]
 - b) Natural disasters in Bangladesh [L3, CLO3]
 - c) Plate boundaries [L3, CLO3]
 - d) GIS [L3, CLO3]

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Soil, Water and Environment Discipline, Khulna University
First Year Second Term; Examination Year 2026; Session: 2024-2025
Course Code: 0541 13 **Math 1259**; Course Title: **Mathematics**
Full Marks: 60; Time: 03 Hours

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Section A (There are four questions in this section. Answer any three questions.)

1. a) Sketch the function and also find the domain and range of 05

$$f(x) = \begin{cases} 2x + 6; & -3 \leq x \leq 0 \\ 6; & 0 < x < 2 \\ 2x - 6; & 2 \leq x \leq 5 \end{cases} \quad [L1, CLO1]$$
1. b) If $f(x) = \begin{cases} x^2, & x < 1 \\ ax + b, & 1 \leq x < 2 \\ 3x - 1, & x \geq 2 \end{cases}$ is continuous then find the value of a, b . 05
 Also show the differentiability at $x=2$ [L2, CLO1]
2. a) An open box is to be made from a 3-ft by 8-ft piece of cardboard by cutting out squares of equal size from the four corners and bending up the sides. What size should the squares be to obtain a box with the largest volume? Also find the largest volume. [L1, 3, CLO1] 05
2. b) Define limit. Explain why $\lim_{x \rightarrow 0} \frac{|x|}{x}$ does not exist? [L2, CLO1] 03
2. c) Find $\frac{d}{dx} [(x^2 + 1)^{\sin x}]$. [L1, CLO1] 02
3. a) A camera mounted at a point 3000 ft from the base of a rocket launching pad. If the rocket is rising vertically at 880 ft/s when it is 4000 ft above the launching pad, how fast must the camera elevation angle change at that instant to keep the camera aimed at the rocket? [L3, CLO2] 05
3. b) If $y = e^{m \cos^{-1} x}$, then show that $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 - m^2)y_n = 0$. [L2, CLO1] 05
4. a) $w = \sqrt{x^2 + y^2 + z^2}$, $x = \cos \theta$, $y = \sin \theta$, $z = \tan \theta$. Use chain rule to find $\frac{dw}{d\theta}$ when $\theta = \frac{\pi}{4}$. [L3, CLO1] 04
4. b) Show that the function satisfies the equation $\frac{\partial z}{\partial t} = c^2 \frac{\partial^2 z}{\partial x^2}$ 04
 $z = e^{-t} \sin\left(\frac{x}{c}\right)$ ii) $z = e^{-t} \cos\left(\frac{x}{c}\right)$. [L2, CLO1]
4. c) Let, $f(x, y) = y^2 e^x + y$. Find f_{xyy} . [L1, CLO1] 02

Section B (There are four questions in this section. Answer any three questions.)

1. a) Evaluate the integral: $\int e^{3x} \cos(2x) dx$. [L3, CLO3] 05
1. b) Evaluate the definite integral: $\int_1^{\sqrt{2}} \frac{dx}{x^2 \sqrt{4-x^2}}$. [L3, CLO3] 05
2. a) Evaluate $\int \frac{2x+4}{x^3-2x^2} dx$. [L3, CLO3] 05
2. b) Integrate using tabular integration by parts. $\int x^2 \sqrt{x-1} dx$. [L3, CLO3] 05
3. a) Determine the area under the curve $y = f(x) = 9 - x^2$ over the interval $[0, 3]$; where x_k^* as the mid point. [use definition of area as a limit] [L5, CLO3] 05
3. b) Integrate the followings: i) $\int \frac{dx}{x\sqrt{1-(\ln x)^2}}$ ii) $\int t^4 \sqrt[3]{3-5t^5} dt$. [L3, CLO3] 05
4. a) Express the following series in integral form when $n \rightarrow \infty$ and evaluate it. 05
 $\frac{1}{n} + \frac{n^2}{(n+1)^3} + \dots + \frac{1}{8n}$. [L3, CLO3]
4. b) Show that $\int_0^3 f(x) dx = \frac{49}{6}$; where $f(x) = \begin{cases} x^2, & x < 2 \\ 3x - 1, & x \geq 2 \end{cases}$. [L2, CLO3] 05

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